AUSTRALIAN
RESEARCH
INDEPENDENT INVESTMENT RESEARCH

Krakatoa Resources
(ASX:KTA)

June 2023

INDEPENDENT
INVESTMENT RESEARCH

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INDEPENDENT INVESTMENT RESEARCH

Krakatoa Resources

(ASX:KTA)

Investment Profile	
Share Price ($) at at 26 May 2023	0.026
Issue Capital:	
Ordinary Shares (M)	363.4
Options (M)	21.2
Performance Shares	15
Fully Diluted (M)	399.6
Market Capitalisation (M)	$9.44
12 month L/H ($)	0.024/0.088

Board and Management

Directors

Colin Locke – Executive Chairman

Timothy Hogan – Non-Exec Director

David Palumbo – Non-Exec Director

Management:

Mark Major - CEO

Major Shareholders	
Helmsdale Investments	5.8%
Lafras Luitingh	5.2%
Peters Investments	4.1%
Board and Management	1.5%

Share Price Performance

CLAY HOSTED RARE EARTH PROJECT DEVELOPER

Krakatoa Resources Ltd is focused of exploring for clay hosted rare earths in Western Australia and in New South Wales and has reported a maiden Resource at its Mt Clere project in WA.

KEY POINTS

Stage of project development matters – On resource related metrics (see Valuation below) Krakatoa is trading broadly in line with a couple of recent entrants to the clay hosted rare earth project development sector, but at a substantial discount to companies that are further down the project development path. It already has a qualifying Resource, so as Krakatoa provides the market with more information about its project, and particularly as it optimises its processing pathway, its share price is likely to appreciate.

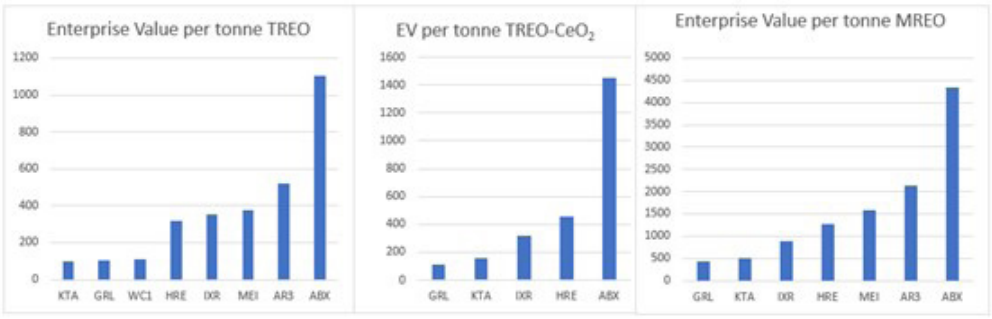
Krakatoa its likely to grow its Tower Resource base substantially – It has 101Mt at 840ppm TREO and an Exploration Target of 87-519Mt at 580-1120ppm TREO. Even without a valuation multiple expansion, the Krakatoa share price should grow with increasing Resources.

The Rand clay hosted rare earth prospect metallurgy results could add shareholder value – The market is unlikely to be placing any value in the current Krakatoa share price for the Rand prospect. It has reported drilling results with a width weighted average grade of 690ppm TREO. Metallurgical results are expected shortly.

Cash at 31 March 2023 A$1.0M and raised A$0.56M in April 2023.

Valuation

Our base case valuation of Krakatoa is 4-8cents per share on peer comparisons using the comparative metrics of Enterprise Value per tonne of Total Rare Earth Oxides (TREO), TREO-Cerium Oxide, and Magnet Rare Earth Oxides in reported Resources.



cps	On TREO	On TREO-CeO2	On MREO
KTA	2.6	2.6	2.6
GRL	2.7	1.9	2.2
WC1	2.9		
HRE	7.7	6.9	6.1
IXR	8.5	4.8	4.3
MEI	9.1		7.4
AR3	12.5		10.0
ABX	26.1	21.3	20.0

Source for charts and table above: Tables 3 and 4 in main body of this report

The table above shows the share prices Krakatoa would be trading at if it was priced on its current Resource using the Enterprise values of the peers with current Resources. Krakatoa appears to be fairly priced against Godolphin (GRL) and West Cobar (WC1) which have reported Resources in the last six months but is at a significant discount to companies that are more advanced like Ionic (IXR), Australian Rare Earths (AR3) and Abx Group (ABX).

INVESTMENT PROPOSITION

In this report the following terms are used which may not be familiar to the investor:

- TREO Total Rare Earth Oxides is the standard measure of a mine's rare earth grades.
- TREO-CeO_2 TREO less Cerium Oxide. Cerium is the most common rare earth and is in significant oversupply to the extent that it is generally not economic to extract it. TREO – CeO_2 is a more useful measure of the economic rare earths in a deposit.
- MREO – Magnet Rare Earth Oxides means Neodymium, Praseodymium, Terbium and Dysprosium which are the components of rare earth magnets and essential for the electric motors and generators where high performance and low weight are required.

STRONG DEMAND FOR MAGNET RARE EARTH ELEMENTS

All rare earth producers are focused on the elements used to make rare earth magnets, which are significantly more powerful per unit of weight than ferrite or other materials and are essential in the manufacture of lightweight but powerful electric motors and wind turbines.

Investors will be very familiar with the growth profile and future prospects for electric vehicle and wind turbine uptake, and rare earth motors are finding their way into all sort of products, including vacuum cleaners, car window controls, e-mobility products and weapons systems. Magnet rare earth elements are critical to those applications.

Supply is dominated by China in mining, and particularly upgrading and magnet manufacture. The rest of the world is seeking diversity of supply as well as expansion of output. Australian companies are well placed to satisfy both goals.

CLAY HOSTED RARE EARTH PROJECTS PART OF THE SUPPLY STORY

The Australian exploration industry is turning its attention to exploring for rare earths in near surface clays. The drivers of this strategy are:

- The ionic clay hosted deposits in China and Myanmar are seen as particularly rich in the Magnet Rare Earth Oxides (Neodymium, Praseodymium Terbium and Dysprosium Nd,Pr,Tb,Dy). This is also the case for the Australian clay hosted rare earth deposits to varying degrees dependent on geology.
- Ionic clay producers in China and Myanmar are the lowest cost sources of rare earths. The Chinese level of costs will not be matched by any project is Australia for a number of reasons, but the main reason is that the Chinese use in situ leaching. In situ leaching involves the injection of an acidic salt solution into the ground, allowing it to flow through the clays to a collection point. The process is destructive to vegetation and subsequent land use is problematic. The destruction caused is fueling protests in China and Myanmar and the trend is to phase out this source of supply.

While the timing and impact of the wind down of Chinese and Myanmar supply is uncertain, it will certainly add considerable pressure on the rare earth supply chain, creating an opportunity for clay hosted deposits in Australia and elsewhere.

WHAT MAKES A CLAY HOSTED RARE EARTH DEPOSIT SPECIAL?

To extract rare earth oxides from hard rock deposits like Lynas' Mt Weld carbonatite deposit or from Iluka's monazite sand stockpile, the minerals containing the rare earths are typically very inert stable structures that must be "cracked". This requires the use of highly concentrated acid or alkaline reagents and considerable heat (600-1000°C) to get the rare earths and everything else into solution in an ionic form that then allows the rare earth elements to be removed as carbonates, then heated to produce oxides.

In clay hosted deposits, time and chemical degradation of the rare earth containing minerals has resulted in the release of rare earths from their original highly refractory minerals into ionic or colloidal forms to the point where the rare earths can be removed from the clay into solution without the expensive cracking process.

Australian clay hosted rare earth deposits discovered so far appear to have most of the rare earths contained in colloidal form rather in the preferable ionic form. In this report, we use the term "clay hosted rare earth" instead of "ionic" to avoid confusion. The metallurgy is discussed from page 8.

The new generation clay deposits in Australia and elsewhere are likely to build their own place in the supply chain using different chemistry and at higher but still competitive operating costs.

IT IS EARLY DAYS IN THE CLAY PROCESSING STORY

A number of the Australian clay hosted rare earth projects are likely to require more aggressive leaching chemistry to achieve recovery rates sufficient for commerciality, which will mean higher operating and capital costs than the Chinese, but as mentioned, the days of the Chinese conducting in situ leaching are probably numbered.

While the market is keen to embrace the clay projects with rare earths that are largely in the ionic phase, the deposits where colloidal rare earths are the dominant phase are legitimate exploration targets. The next twelve months are likely to deliver a lot of information to the market from the dozen or more companies working in this space.

The journey to discover the lowest cost processing routes is in its infancy in many respects but builds on a significant pool of expertise at ANSTO in particular and the Australian mineral processing industry in general.

The major processing questions include:

- Is a particular horizon within the deposit more amenable to lower cost processing? The answer is very likely to be affirmative, in which case, for relatively thick deposits, should mining focus of a specific horizon? While this is a geological and mining matter, it is driven by the processing outcomes.
- Can the clays be upgraded by cheap gravity separation to reduce the mass but retain most of the leachable rare earths. The initial conclusions of a number of project developers appears to be that significant upgrading can occur.
- Selection of the lixiviant that best extracts rare earths from the clay with the lowest recovery of impurities, and the most economical way maximising recovery into Mixed Rare Earth Carbonate (MREC). At this stage, most project developers are reporting extraction rates, and only Ionic Rare Earths and Australian Rare Earths are talking about the carbonate stage. While the leaching characteristics of each deposit will vary, the fact there are so many companies participating in the investigation means that the knowledge base should grow very quickly.

KRAKATOA CLAY HOSTED RARE EARTH PROJECT UNDERVALUED

Krakatoa Resources' Tower deposit and the greater Tower region is an example of this new generation of rare earth deposit.

At this stage of its project development, it is not possible to value Krakatoa's Tower project on its fundamental economics. It has yet to land on a final metallurgical flowsheet and has almost certainly will increase its Resources in both the current Tower area of interest, and the region around it.

Peer Comparison values Krakatoa at between 3.0cps and 12.6cps

It is possible to compare Krakatoa's Tower Project to a number of other clay hosted rare earth projects.

While the Resource growth should have a positive impact on the share price, Krakatoa's current share price (2.6cps) is below the bottom end of the 3.0cps to 12.6cps range implied by its peers, and significantly below the median valuation of around 4cps to 7cps as summarised in the table below.

Table 1 Krakatoa valuation using peer Resource based multiples

Krakatoa						
Share Price A cps	3.0	12.6	5.0	7.1	4.5	10.1
Market Cap A$M	11.1	45.8	18.1	25.7	16.3	36.8
Enterprise Value A$M	10	44.3	16.5	24.1	14.7	35.2
EV A$/t TREO	112	522				
EV A$/t TREO-$CeO_2$			315	459		
EV A$/t MREO					890	2125

Source: Tables 3 and 4

The table above works from the bottom up, starting with the Enterprise Values per tonne measured in terms of Total Rare Earth Oxides (TREO), TREO less Cerium Oxide (CeO_2), and Magnet Rare Earth Oxides (Neodymium, Praseodymium, Terbium and Dysprosium Nd, Pr, Tb, Dy).

We have taken the per tonne values from the nine companies in the peer group, being all the Australian listed clay hosted rare earth project developers with reported Resources, and eliminated the highest and lowest of the values that can be seen in Table 2, leaving the range shown in the table above.

Using the existing Tower Resource, these ranges have been turned into Enterprise Values in A$M and then converted into Market Capitalisation in A$M by adjusting for cash at 31 March 2023. The Market Capitalisations have been presented as per share values using the shares on Issue at the date of this report.

- On contained TREO, KTA should trade at between 2.9 and 12.5cps
- On TREO-CeO_2, KTA should trade at between 5.0cps and 7.1cps
- On what really matters, ie MREO, KTA should trade at between 4.4cps and 10.1cps

This valuation doesn't include any exploration upside

All these companies are still exploring or have just started exploring their tenements, so they are all likely to increase their Resources. It is not possible to estimate how much additional discovery is priced in. Krakatoa has an exploration target that flags the addition of between 35% and 590% more TREO.

Highest Krakatoa valuations come from using Magnet Rare Earth metrics

In the future, production of NdPrTbDy will be the driver of total rare earth production, as it is today, which means most of the other rare earths will be in oversupply, and unconstrained by lack of raw material availability. This means that the bulk of the revenue a miner will earn will be largely derived from the revenue from NdPrTbDy.

The highest valuations for Krakatoa come from using EV A$/t MREO metrics. While an enterprise valuation of A$100M looks excessive at the company's current stage of development, there are a number of peers trading at Enterprise Values of A$20-70M, and some of those have smaller Resources.

Project delivery appears to drive increased Enterprise Value

- Ionic Rare Earths (IXR) has a Definitive Feasibility Study and an Enterprise Value of A$72.3M
- Australian Rare Earths (AR3) has completed a trial mine and produced a Mixed Rare Earth Carbonate sales product from its pilot plant and has an Enterprise Value of A$43M.
- Both projects have a number of similarities to the Krakatoa Tower project and should be considered comparable. Meteoric has an Enterprise Value of over A$400M, but is substantially higher grade and larger, and appears to have superior metallurgy, so is not a like for like comparison.
- The peers at smaller market capitalisations have less Resources and are at earlier stages of development, but are also changing quickly and it would not surprise to see the share prices of a number of Krakatoa's peers appreciate as they deliver project milestones, taking the Krakatoa share price with them.

The large number of clay hosted projects will educate the investor quickly

- The market is typically quick to value gold discoveries because the economics of gold mining and processing is well understood by investors. Investors need a lot more assistance from rare earth project developers to understand the economics specific to individual rare earths projects because each is relatively unique.
- However, given the number of clay hosted rare earth projects being developed by Australian companies, the amount of information hitting the market will expand the investors knowledge base far greater than if there were only one or two companies.
- There is likely to be strength in numbers. As investors become more familiar with the economics of the sector, the market is likely to recognise value in project developers earlier. We see this as likely to favourably impact Krakatoa over the next twelve months.

RISKS

All equities face general market risks. There are some specific risks of importance to mining operations in general and rare earth miners in particular:

Rare Earth Prices – All projects are leveraged to the prices of the commodities they produce, and explorers' share prices appear to be leveraged in the short term to the direction of the prices of their particular commodities. Rare earth projects are no different. We have not attempted to forecast rare earth oxide prices in this report. However, we note that there is general consensus that demand for the magnet rare earths is likely to very rapid at high single digit or low double digit annual growth rates of the next decade or two, and such rapid growth rates tend to result in more commodity price upside surprise than downside surprise.

Project costs – Of the peers in this report, only Ionic Rare Earths have produced a Definitive Feasibility Study with any costs, so it is the only company with specific cost risk at present. However, the sector in general is at risk with respect to project construction costs. In Australia, the increase in labour costs appears to be peaking, and construction costs are likely to become more predictable over the next couple of years, reducing this risk somewhat.

Operating costs – Rare earth projects generally have a far greater sensitivity to reagent costs than most other commodity projects. The closest comparable would be HPAL lateric nickel operations like Murrin Murrin near Laverton, which is a high consumer of sulphur and fresh high-quality water.

Approvals – All mining projects need to earn a licence to operate. In the case of clay hosted rare earth deposits, they are likely to be high tonnage (5Mtpa). To produce this rate of production from a clay band typically 10-30m thick lying parallel to the surface, the mine will have to disturb between one and three square kilometres of land each year. This will require sensitive management of local communities. In the case of Krakatoa, its Tower project is not on farmland, so it will face a less onerous approvals process.

COMPARISON WITH PEERS

The table below includes all the Australia listed clay hosted rare earth projects with Resources. The valuation approach is driven by the size of the last published Resource and the rare earth grades which are presented in terms of Total Rare Earth Oxides (TREO), TREO less cerium oxide, and Magnet Rare Earths (MREO ie Neodymium, Praseodymium Terbium and Dysprosium or Nd,Pr,Tb,Dy)

Table 2 Summary of Enterprise Values and rare earth Resource related valuation metrics

References	MEI	IXR	AR3	ABX	KTA	WC1	GRL	HRE
Share Price A cps	22.0	2.2	34.0	10.0	2.6	9.0	6.1	12.0
Market Cap A$M	416	86.8	52.1	22.4	9.4	8.7	7.2	8.2
Enterprise Value A$M	406	72.3	43.1	17.9	7.9	5.8	5.4	5.6
EV A$/t TREO	378	352	522	1104	93	112	102	319
EV A$/t TREO-CeO2	na	315	na	1453	150	na	113	459
EV A$/t MREO	1572	890	2125	4338	476	na	432	1277

Source: Tables 3 and 4

Table 3 includes the companies that have Enterprise Values greater than Krakatoa. Of these, Meteoric is in a class of its own on grade and contained TREO. Krakatoa is in the table below.

Ionic Rare Earths and Australia Rare Earths have deposits have similar to Krakatoa estimated at somewhat similar cutoff grades (IXR 200ppm TREO-CeO_2 and AR3 325ppm vs KTA 300ppm). Both are more advanced with Ionic publishing a Definitive Feasibility Study and is about to start pilot plant construction, and Australian Rare Earths has generated product at a pilot plant.

In Table 4, Krakatoa is the largest by Enterprise Value, but not by much. All the companies in this table are recent entrants to the clay hosted rare earth business, and for all of them there is potential for material increases in Resources. HRE is flagging it is likely to more than double its Resource in Q3 2023 and that appears to be priced into its EV/tonne metrics already.

Krakatoa appears to be trading on similar metrics to Godolphin. From an investment point of view, we would probably prefer Krakatoa because it has 100% of its project, and has published an exploration target clearly signaling significant upside.

Table 3 Peer Comparisons Part 1 – Companies with Enterprise Values A$405M to A$17.9M

ASX Code	MEI	IXR	AR3	ABX
Company	**Meteoric Resources**	**Ionic Rare Earths**	**Australian Rare Earths**	**ABX Group**
Location	Brazil	Uganda	SA Vic	Tasmania
Share Price A cps	22.0	2.2	34.0	10.0
Issued Shares M	1892	3946	153	224
Options Etc M	241	157	42	79
Market Cap A$M	**416.2**	**86.8**	**52.1**	**22.4**
Cash A$M	27.0	14.5	9.0	4.5
Debt A$M	16.4	0.0	0.0	0.0
C-Notes A$M	0.0	0.0	0.0	0.0
Enterprise Value A$M	**405.7**	**72.3**	**43.1**	**17.9**
EV A$/t TREO	**378**	**352**	**522**	**1104**
EV A$/t TREO-$CeO_2$	**na**	**315**	**na**	**1453**
EV A$/t MREO	**1572**	**890**	**2125**	**4338**
Project Name	**Caldeira**	**Makuutu**	**Koppamurra**	**Tasmania**
Interest	100%	60%	100%	100%
Resource Mt	**409**	**534**	**101**	**21**
TREO ppm	2626	640	818	770
TREO-CeO_2 ppm	0	430	0	585
MREO ppm	631	152	201	196
TREO kt	**1074**	**342**	**83**	**16**
TREO-CeO_2 kt	**0**	**230**	**0**	**12**
MREO kt	**258**	**81**	**20**	**4**
Cut-off TREO-Ce ppm	1000	200	325	250

Source: See Table 5

Table 4 Peer Comparisons Part 2 Companies with Enterprise Values A$9.4m to A$8.2M

ASX Code	KTA	WC1	GRL	HRE
Company	**Krakatoa Resources**	**West Cobar Metals**	**Godolphin Resources**	**Heavy Rate Earths**
Location	WA NSW	WA	WA	WA
Share Price A cps	2.6	9.0	6.1	12.0
Issued Shares M	363	97	118	68
Options Etc M	35	21	2	14
Market Cap A$M	**9.4**	**8.7**	**7.2**	**8.2**
Cash A$M	1.6	2.9	1.9	2.6
Debt A$M	0.0	0.0	0.0	0.0
C-Notes A$M	0.0	0.0	0.0	0.0
Enterprise Value A$M	**7.9**	**5.8**	**5.4**	**5.6**
EV A$/t TREO	**93**	**112**	**102**	**319**
EV A$/t TREO-$CeO_2$	**150**	**na**	**113**	**459**
EV A$/t MREO	**476**	**na**	**432**	**1277**
Project Name	**Tower**	**Newmont**	**Narraburra**	**Cowalinya**
Interest	100%	100%	75%	100%
Resource Mt	101	44	95	28
TREO ppm	840	1192	739	625
TREO-CeO2 ppm	520	0	500	435
MREO ppm	164	0	131	156
TREO kt	85	52	70	18
TREO-CeO_2 kt	53	0	47	12
MREO kt	17	0	12	4
Cut-off TREO-Ce ppm	300	500TREOY	300	300

Source: See Table 5.

Table 5 References for data I Tables 3 and 4

Company Code	Resource	Cash	Shares on Issue	Leaching	Ore Upgrading
ABX	8-May-23	27-Apr-23	28-Apr-23	2-Feb-23	16-May-23
AR3	3-Apr-23	28-Apr-23	11-May-23		
GRL	16-Apr-23	27-Apr-23	10-Mar-23	2-Apr-23	
HRE	22-Aug-23	27-Apr-23	14-Mar-23		13-Dec-22
KTA	21-Nov-22	26-Apr-23	28-Apr-23	23-Jan-23	
MEI	1-May-23	28-Apr-23	26-May-23		
IXR	20-Mar-23	26-Apr-23	6-Mar-23		
WC1	8-Sep-22	27-Apr-23	7-Feb-23		

Source: Refer company releases on the dates nominated in the table

OTHER FACTORS

Other assets

A number of the peers have either acquired downstream or recycling assets or have joint ventured in some downstream business. We are skeptical that the market adds much value for these assets. The market has a habit of focusing on the major story for emerging companies and can even discount the share price for perceived lack of focus on the key project.

A number of companies, including Krakatoa, have other exploration assets at various stages of development. We have not adjusted for any of these assets in our comparisons.

Scandium by-product

Some companies have flagged scandium as a by-product. While scandium is a very interesting emerging commodity, it is worth keeping in mind that every rare earth producer is actually a magnet rare earths producer with 11 other by-products already, so collecting scandium is one more. Ultimately, it is all about margin, which will include revenues from all sources.

To the extent that scandium is technically easy to recover, adding it to a project is a positive for costs and cash flow. However, if the project depends on producing scandium and its production is less than technically simple, then it is making an already metallurgically complex operation more difficult.

Companies reporting scandium in their deposits include:

- Ionic Rare Earths – and its production is a significant contributor to the DFS cash flow
- Krakatoa

Zircon by-product

While scandium would be produced from the back end of the processing plant as a carbonate, zircon would be produced in the first stage of processing using gravity separation. These techniques are simple and well understood, so a zircon by-product if commercial would add revenue with very little technical risk.

Krakatoa has an average 823ppm of zircon at Tower

In a release dated 19 May 2022, the company reported zirconium oxide was also elevated within several zones of the regolith (i.e. the decomposed rock strata near surface), with several assays higher than 1000ppm returned and an average of 553ppm within intervals >200ppm TREO i.e. within the reported Resource area.

While the company reported zirconium oxide in line with the reporting of all the rare earths as oxides, the zirconium is actually in the form of zircon ($ZrSiO_4$), and a zirconia grade of 553ppm translates to a zircon grade of 823ppm.

The average price Iluka realised for its average of premium and standard grades of zircon in the March 2023 quarter was US$2053/tonne or A$3064/tonne. Assuming Krakatoa can recover 70% of contained zircon, the benefit to a rare earth project would be A$1.76/tonne of ore mined. To put that in context, Ionic is estimating around A$24/t ore mined for its total operating cost at Makutu.

RARE EARTH METALLURGY – A QUICK LOOK

CLAY HOSTED DEPOSITS CONTAIN FOUR FORMS OF RARE EARTHS

While the mining of these deposits will be a very simple, low cost, free dig operation, the heart of the business, and most of the challenges, will revolve around metallurgical recoveries.

In this context it is important to understand that metallurgical test work to determine recovery is a more complex business for clay hosted rare earths than for other metals and also more complex than for hard rock rare earth deposits.

Rare Earths can exist in clays in various forms including:

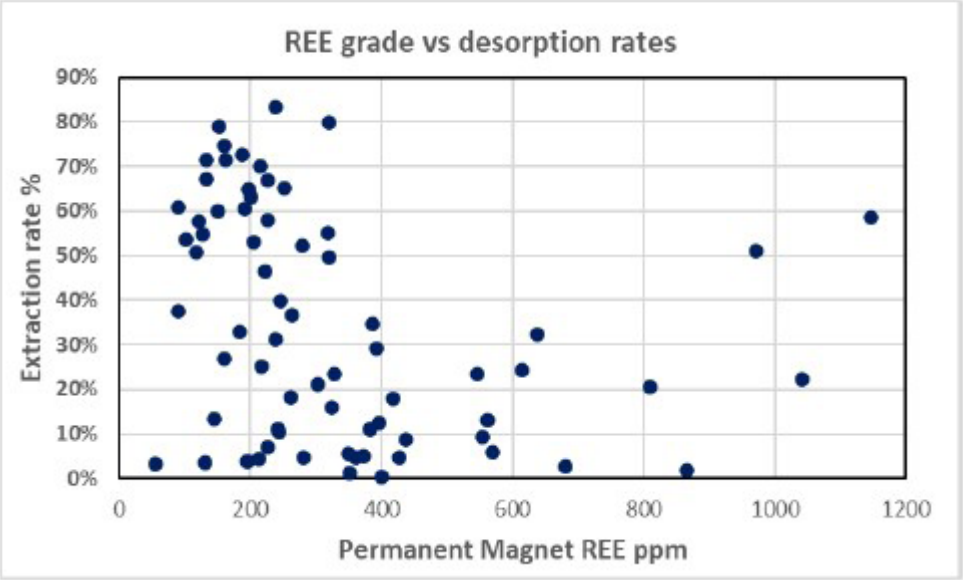
- **Aqueous soluble phase** where the rare earth elements are not absorbed by clay minerals (Ionic – least common form)
- **Ion exchangeable phase** where rare earths are absorbed into clays (Ionic – most common form)
- **Colloidal sediment phase** rare earths where the rare earth exists as a rare earth oxide or hydroxyl bonding with an oxide material (Colloidal)
- **Mineral phase** rare earths in the original crystalline hard rock source mineral (Refractory)

Ionic rare earths will enter solution at room temperature, pH 3-4, using ammonium sulphate as lixiviant and achieve up to 90% recovery. These phases are mined by the Chinese.

The colloidal rare earth sediment, formed during the weathering process, exists as an undissolved oxide or hydroxide phase in the ore, that when contacted with acidic conditions, solubilises and releases the rare earth elements into solution. Colloidal rare earths require pH levels around 1 in order to be extracted. A large proportion of the rare earths in the Australian clay hosted rare earth deposits are likely to be in this form.

The refractory rare earths require the same processing as hard rock rare earth deposits and require corresponding high grades to be economic. This phase is not recovered from clay deposits.

Figure 1 ABx Group recovery range highlights the variety of rare earth compounds in a deposit



Source: ABX release 2 February 2023

The figure above shows excellent recovery of rare earths from some samples and almost zero from others even though the grade is the same. For example, samples with a grade of 200ppm MREE have recoveries ranging from 3% to 73%. That is a reflection of the impact of the different phases of rare earth minerals in clay hosted deposits.

EXTRACTION INTO SOLUTION IS NOT TOTAL PROJECT RECOVERY

Overall recovery = extraction into leach solution plus recovery into MREC

Overall recovery into product is a combination of the rare earth extraction rate from ore into solution and recovery from solution into carbonate.

Most of the recovery data reported by ionic clay project developers is referring to the extraction of rare earths from the clay into solution.

In a processing facility, the rare earths would have to be precipitated out of solution and into a Mixed Rare Earth Carbonate (MREC) of a high grade of purity. A number of project developers are aiming for 96% MREC or better.

High acidity in the leach created issues during the carbonate precipitation stage

There will be losses of rare earths during the Precipitation Step, and losses increase as a higher purity of Mixed Rare Earth Concentrate is required, and losses also increase with increased concentration of aluminium and iron in the extracted solution.

The amount of non-rare earth elements in solution is very sensitive to the acidity of the solution which is measured in terms of pH. A pH of 7 is neutral i.e. neither acid nor alkaline. At a highly acidic pH of below 0.5, almost all metals will be pulled into solution including aluminium and iron. At a pH of 4, very little aluminium and iron leaves the ore.

The extraction rate of rare earths in the colloidal phase within the clay is also related to the pH, and for most of the Australian deposits, the rare earth recovery at pH4 is not commercial.

Practical examples: Overall process recoveries for two projects with completed Feasibility Studies

Table 6 Extracts from Feasibility Studies by two ionic rare earth project developers

	Code	Head Grade TREO ppm	Salt	pH	Recovery into MREC
Ionic Rare Earths	ASX:IXR	848	(NH4)2 SO4	2	27.0%
Aclara	TSX:ARA	2045	(NH4)2 SO4	3-4	21.9%

Source: Aclara 43-101 2021 and IXR release 20 March 2023, $(NH_4)_2\,SO_4$ = Ammonium Sulphate

KRAKATOA/TOWER RECOVERY

Table 7 Mineral content of metallurgical test samples vs Resource grade

Element	KC0081	KC0100	KC0155	KC0243	KC0244	Ave Element Grade	Oxide Grade	Adj Grade	Basket Split
La ppm	110	81	167	87	155	120	140.7	141.8	16.9%
Ce ppm	438.0	141.0	363.0	211.0	285.0	287.6	353.3	355.9	42.4%
Pr ppm	24.0	17.0	31.0	20.0	33.0	25.0	30.2	30.4	3.6%
Nd ppm	90.0	65.0	115.0	76.0	132.0	95.6	111.5	112.3	13.4%
Sm ppm	18.0	13.0	20.0	15.0	25.0	18.2	21.1	21.3	2.5%
Eu ppm	4.0	3.0	5.0	4.0	6.0	4.4	5.1	5.1	0.6%
Gd ppm	16.0	13.0	19.0	14.0	23.0	17.0	19.6	19.7	2.3%
Tb ppm	3.0	2.0	3.0	2.0	3.0	2.6	3.1	3.1	0.4%
Dy ppm	16.0	13.0	16.0	15.0	19.0	15.8	18.1	18.3	2.2%
Ho ppm	3.0	3.0	3.0	3.0	4.0	3.2	3.7	3.7	0.4%
Er ppm	10.0	7.0	9.0	9.0	12.0	9.4	10.7	10.8	1.3%
Tm ppm	1.0	1.0	1.0	1.0	2.0	1.2	1.4	1.4	0.2%
Yb ppm	9.0	6.0	7.0	9.0	12.0	8.6	9.8	9.9	1.2%
Lu ppm	1.0	1.0	1.0	1.0	2.0	1.2	1.4	1.4	0.2%
Y ppm	72.0	75.0	89.0	73.0	101.0	82.0	104.1	104.9	12.5%
LRE	661	304	675	394	604	528		662	78.8%
HRE	43	33	39	41	53	42		178	21.2%
TRE+Y	814	441	846	542	812	691	834	840	100.0%
CREO	205	172	254	186	288			269	32.0%
MREO	133	97	165	113	187			164	19.5%
TREO-CeO_2								520	61.9%

Source: KTA metallurgical release 23 January 2023, KTA Resource release 21 November 2022

Krakatoa has not provided the market with a breakdown of the rare earth mineral mix in the Tower deposit but has provided detail on the samples that were tested for metallurgical performance.

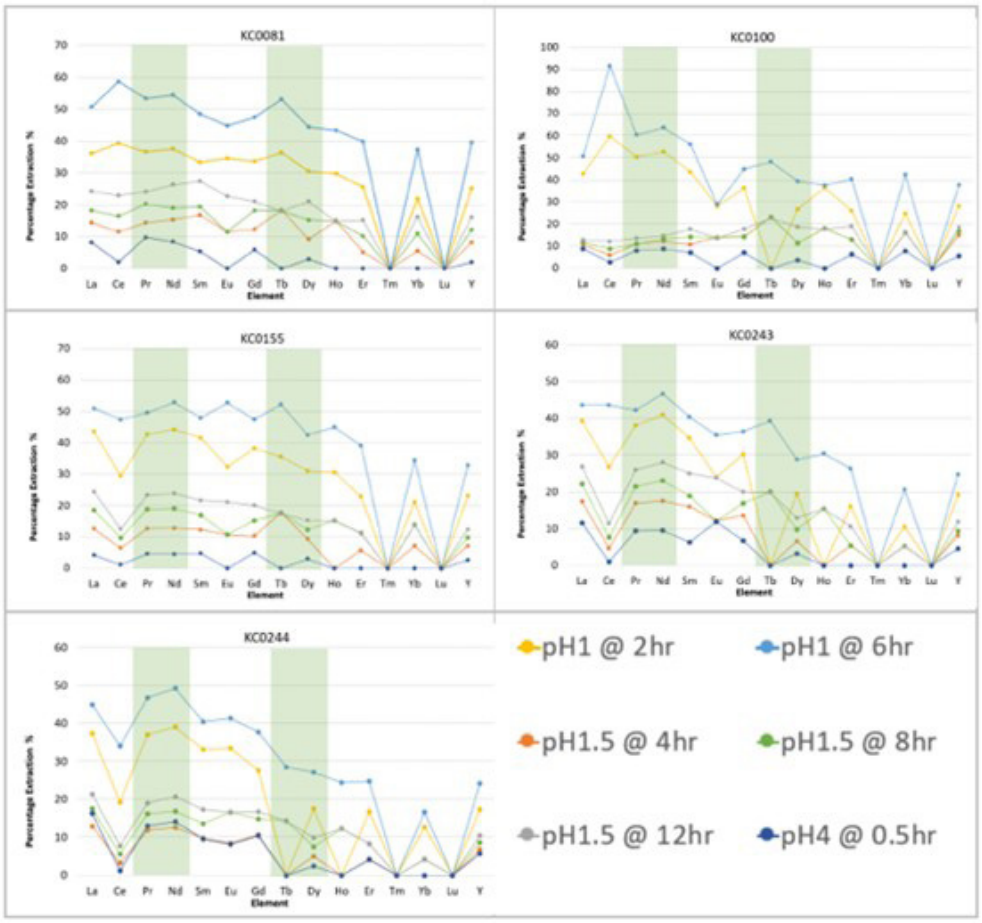
In the table above, we have taken the elemental analysis, converted the rare earth elements into oxides (Oxide Grade) using standard factors found in Table 1 attached to any Resource announcement, and estimated the average rare earth oxide content of the samples.

We have used this table to estimate the Magnet Rare Earth oxides in the Tower deposit, so we can compare the grades to the recovery data in Figure 2.

The test samples have a higher light RE grade and lower heavy RE grade than the Resource.

The company has said that "the Tower deposit is characterised by a combination of ionically absorbed, acid soluble and refractory minerals. Comparatively, these results are very similar to other extraction results generated by globally significant and well-known clay hosted rare earth projects with similar processing methods." (Source: KTA release 23 January 2023).

Figure 2 Tower recoveries under various conditions (Lixiviant is ammonium sulphate at 50 C)



Source: KTA release 23 January 2023

The recovery of around 10% of the rare earth elements at pH 4 points to the amount of rare earth in the ionic phase, with another 30% in the colloidal phase.

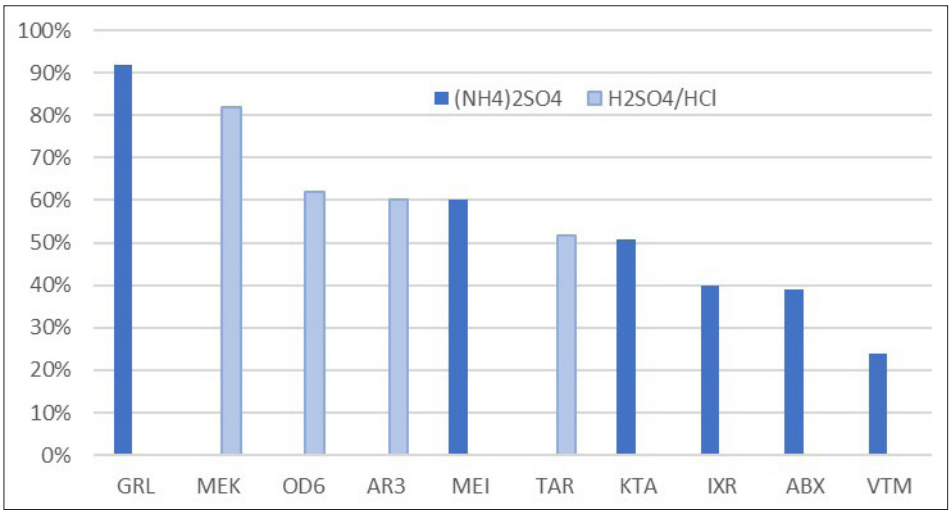
Krakatoa has one of the best extraction rates using its leaching conditions

The best extraction rates achieved by Krakatoa were around 51% for the magnet rare earths using ammonium sulphate, a pH of 1 and a residence time of six hours.

ABx and Meteoric have deposits that can achieve commercial rates of recovery at a pH of 4 and room temperature. However, all the rest have to use very low pH. Some companies are using sulphuric or hydrochloric acid as the lixiviant (and do not bother to report the pH which would probably be below 1).

Of the remainder using ammonium sulphate or $(NH_4)_2SO_4$, Krakatoa achieves the best recoveries apart from Godolphin. On testing so far, the Tower Deposit performs better than Ionic's Makutu or Victory's North Stanmore project.

Figure 3 Extraction Rates companies using ammonium sulphate leach is dark blue



Source: Table 8

Table 8 Extraction rates for Magnet Rare Earth Oxides and the leaching conditions used

Code	Company	Lixiviant	Acidity pH	Residence time hr:min	Temp °C	MREO Extraction
ABX	ABX Group	$(NH_4)_2SO_4$	4	0:30	22	39%
AR3	Australian RE	$MgSO_4$	1	2:00	22	60%
GRL	Godolphin Resources	$(NH_4)_2SO_4$	2	24:00	50	92%
IXR	Ionic RE (Tests)	$(NH_4)_2SO_4$	1		22	40%
MEI	Meteoric Resources	$(NH_4)_2SO_4$	4-4.5		22	60%
VTM	Victory Metals	$(NH_4)_2SO_4$	0.7	4:00	50	24%
KTA	Krakatoa Resources	$(NH_4)_2SO_4$	1	6:00	0	51%
MEK	Meeka Metals	H_2SO_4		6:00	50	82%
OD6	OD6 Metals	HCl		6:00	0	62%
TAR	Taruga Minerals	H_2SO_4		6:00	50	52%
IXR	Ionic RE (DFS)	$(NH_4)_2SO_4$	2		22	27%

Sources: Company releases ABX 2 Feb 2023, AR3 16 May 2023, GRL 5 Apr 2023, IXR 4 Aug 2020, MEI 20 Dec 2022, VTM 1 May 2023, KTA 23 Jan 2023, MEK 25 July 2022, OD6 2 Apr 2023, TAR 15 Dec 2022

Potential to upgrade before leaching

A number of companies (OD6, IXR,ABX,HRE) have indicated that they are looking to separate out a fines fraction with the separation point at 75 microns in size for some and 25 microns for others. Early test work appears to suggest the fines account for 40-60% of the Resource mass and contain 60-90% of the rare earths.

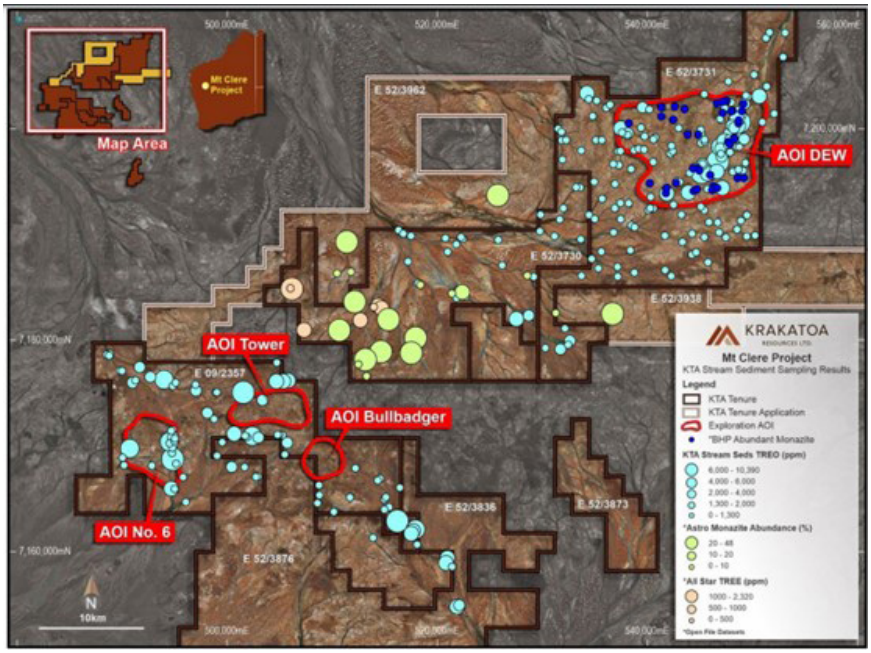
In itself, the grade uplift could represent a significant improvement in economics, but the market is also awaiting the metallurgy results to see if there is also an improvement in extraction rates relative to the extraction rates from the whole ore leaching.

DESCRIPTION OF ASSETS

MT CLERE RARE EARTH PROJECT (KTA 100%)

Location

Figure 4 Mt Clere tenement location and results of historical exploration by previous owners



Source: KTA Presentation 22 February 2022

The tenements were previously explored by BHP, Astro and others for mineral sands. They detected significant concentrations of rare earth containing monazite but were not interested in rare earths at the time. Krakatoa had suspected that over geological time, the rare earths in the monazite could have mobilised within the regolith and become associated with clay minerals like the smectite typical of the region.

Resources

Tower Resource reported 21 November 2022

Table 9 Tower Resource

	Zone	Material	TREO	TREO-CeO2	CREO	LREO	HREO	U3O8	ThO2
		(Mt)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Indicated	3	30	860	500	240	670	190	2.0	29
Indicated	4	10	730	440	220	550	170	1.0	35
Total		40	820	480	230	640	180	1.0	31
Inferred	3	43	910	570	300	640	270	2.0	33
Inferred	4	18	710	480	270	460	250	2.0	31
Total		61	850	540	290	590	270	2.0	32
Total		**101**	**840**	**520**	**270**	**610**	**230**	**2.0**	**32**

Source: KTA release 21 November 2022

The Tower Area of Interest was drilled in 2021 resulting in the initial discovery and the formulation of an Exploration Target on 19 May 2022.

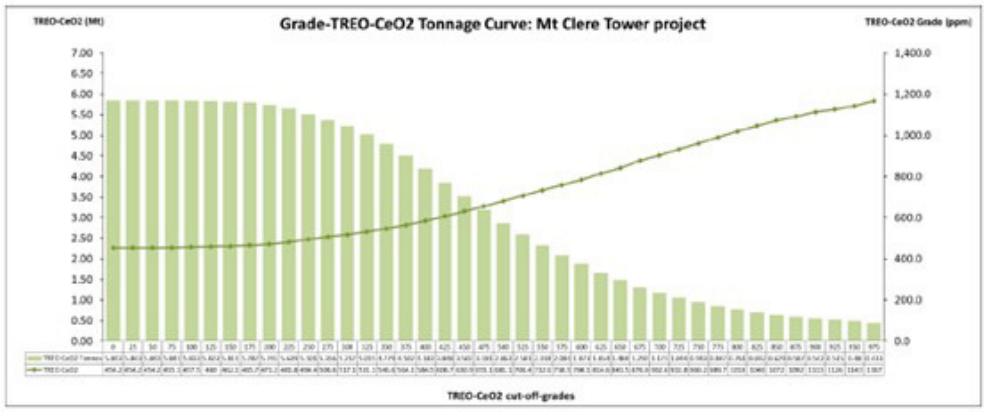
Further drilling occurred in 2022 resulting in the Resource published on 21 November 2022.

However, as can be seen in the figure above, there are indications of rare earths over widespread areas of the tenements, not just in the Tower Area of Interest, creating potential for discovery of significant additional Resources.

Krakatoa has reported a Resource of 101Mt at 840ppm TREO using a cut-off grade of 300ppm TREO-CeO2 which gives a TREO-CeO2 contained of 5.2mt in the figure below.

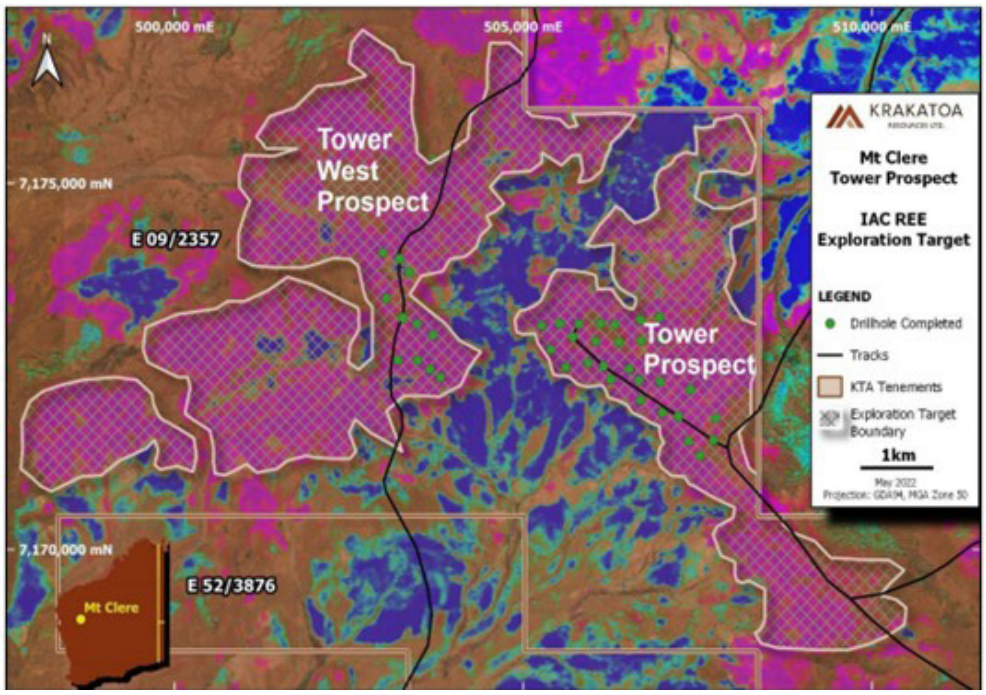
There appears to be little possibility of mining a high grade core of this deposit. As evident in the grade tonnage curves below, the grade appears to be fairly evenly distributed and to achieve low costs, bulk mining rather than selective mining would be preferable. Bulk mining allows larger equipment with lower A$/t operating costs, and less grade control drilling costs, but requires the processing plant to handle the increased tonnage.

Figure 5 Grade tonnage curve in Total Rare Earth Oxides less Cerium Oxide



Source: KTA release 21 November 2022

Figure 6 Tower and Tower West prospects – The reported Resource relates to the Tower Prospect only



Source: KTA release 19 May 2022

Krakatoa's initial drilling in 2021 included holes 1-11 which tested the Tower West prospect. Those holes intersected an average grade of averaged 579ppm TREO so there is potential for a material resource there with grades likely to be similar to those at Tower (also called Tower Central).

EXPLORATION TARGETS

The old Exploration Target looks conservative

In a release dated 19 May 2022, there was an Exploration Target of between 87 to 519 million tonnes grading 580-1120 ppm TREO for 50-581Kt Rare Earth Oxides.

Table 10 Assumptions used to construct the new Exploration Target

Parameter	Comments
Geological model	Based on drill hole regolith logging, assay results, geological mapping, radiometric and spectral imagery
Bulk Density	1.78 g/cm^3 – estimated based on known clay material characteristics and reflects same density as the Mineral resource estimate
Number of drill holes,	139 drill holes in total: 39 logged and assayed over the Tower West area, plus 100 holes drilled and assayed that make up the Mineral resource estimates over the Tower central and southern area; Clay hosted >500ppm TREO intersection identified with geological information
Cut-off grades	200ppm TREO, no other element cut offs were used
Target grade	>750ppm TREO
Mineralisation zonation factor – dilution factor	REO zone thickness in drilled areas were averaged and those REO zone thickness outside the drilled area is discounted by ~35-40% to account for variability in mineralisation zonation due to topographical and basement highs.

Source: KTA release 21 November 2022

The new Exploration Target

When the 101Mt @ 840ppm TREO reported Resource was reported on 21 November 2022, it included a new Exploration Target outside the Resource of 57 to 481Mt @ 530 -1050 for 30kt to 505Kt of Rare Earth Oxides (REO) based on the potential in Tower West and extensions to Tower.

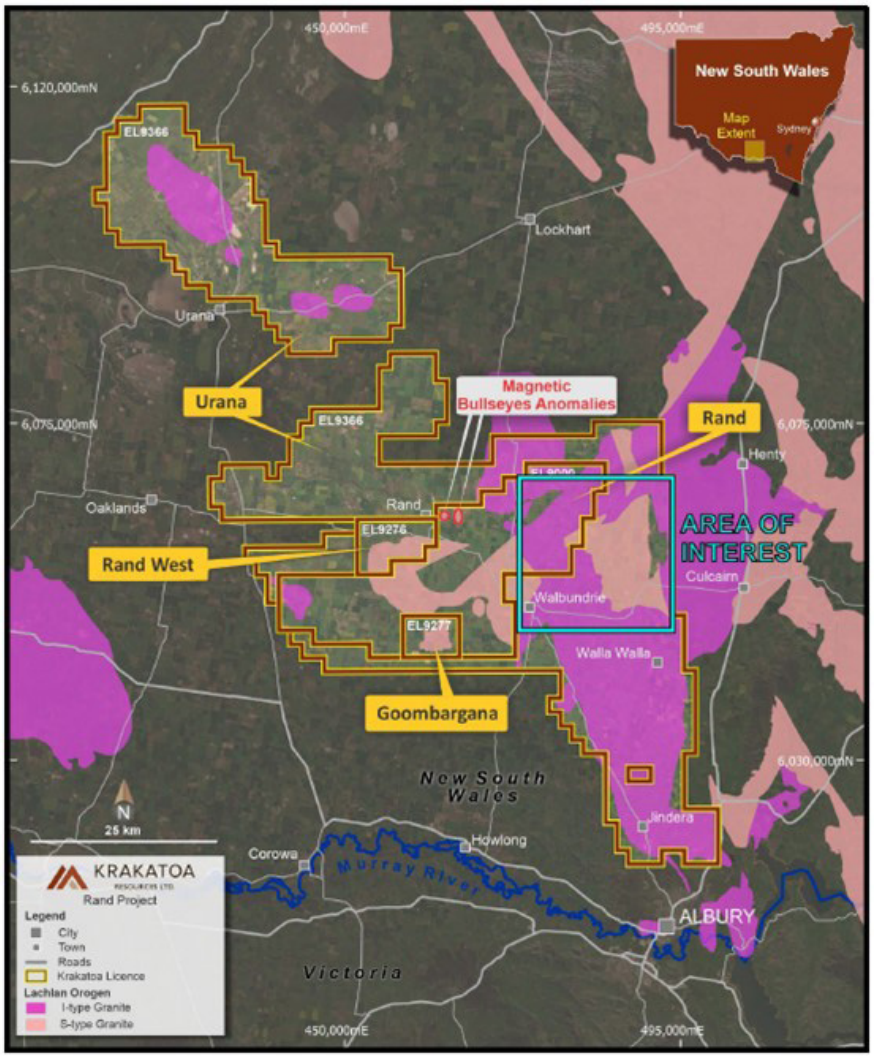
The original Exploration Target appears to have included 30-38Mt in the Tower area that has been converted into 101Mt of Resources, suggesting that the Target is very conservative.

The Exploration Target gives the market a clear indication that the Resource is likely to expand with continued drilling, and there is potential for an ultimate Resource of more than 500Mt, putting it on a par with the Resource of Ionic Rare Earths.

RAND RARE EARTH PROJECT (KTA 100%)

Location

Figure 7 Location of Rand Project and areas of interest within the tenements

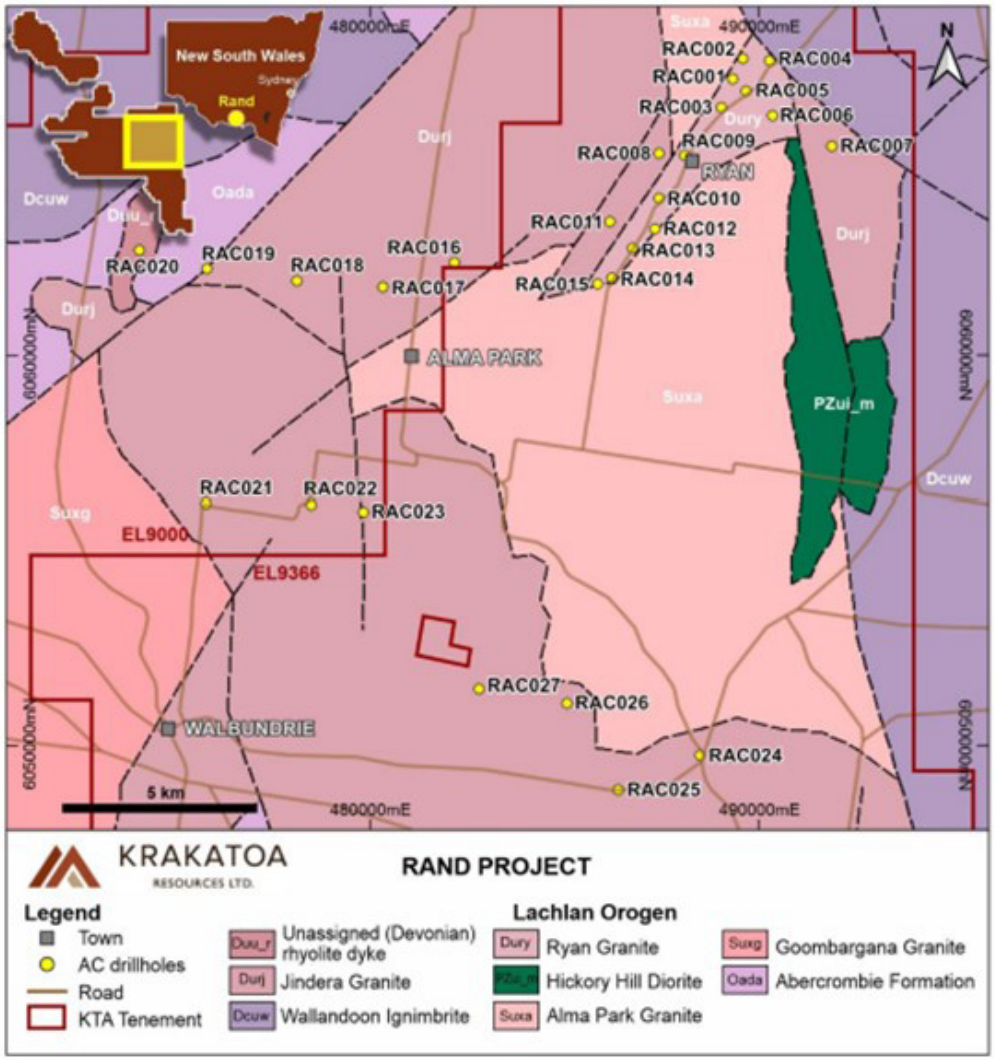


Source: KTA 26 April 2023

This project is in the same general Murray Basin system as Australian Rare Earths, but further to the east. Krakatoa is conducting metallurgical testing to determine the nature of the mineralisation. A positive result could see a significant increase in activity at this project.

Current Activity

Figure 8 Rand rare earth prospect drill collar locations



Source: KTA release 8 May 2023

Krakatoa completed a 27 hole, 1318m Air Core (AC) drill program, focused on REE targets including the highly prospective REE-enriched Ryan and Jindera Granites. The AC program was drilled on roadside easements during February 2023.

Eight holes were collared within EL9000 "Rand" and the remainder on EL9366 "Urana" (Figures 7 and 8). A total of 27 vertical, 89mm diameter holes (RAC001 to 027 inclusive) for 1318.7 metres were completed.

Twelve (12) holes tested the Ryan Granite at ~1km centres along 7.5 km of (NE-SW) strike, a further 12 holes tested the northern Jindera Granite as wide-spaced E-W fences with 1.5 to 2.5km spacings and RAC020 tested an unassigned Devonian rhyolite dyke ("Duu r"; Figure 8).

Shallow AC intersections over the Ryan and Jindera Granites returned high magnetic rare earth oxides (MREO) and critical rare earth oxide (CREO) levels.

The Company will now undertake some initial leach kinetic testwork on selected samples to determine how amenable the REE are too simple lixiviant mobilisation.

Table 11 Rand drilling detail - Thicknesses of 3-28 metres at Magnet Rare Earth Oxide grades of 108-478ppm

HoleID	From (m)	Width (m)	TREO ppm	TREO-CeO_2 ppm	CREO ppm	MREO ppm	HREO %	CREO %	MREO %
RAC001	34	3	782	463	268	188	31	34	24
RAC002	1	7	572	424	242	185	64	42	32
RAC003	34	6	553	343	202	136	33	37	25
RAC004	2	16	786	629	351	277	37	45	35
incl	6	12	887	189	422	335	39	48	38
incl	6	8	1056	228	507	414	61	48	39
incl	6	4	1302	1095	631	482	42	48	37
RAC005	28	4	503	414	229	182	37	46	36
and	44	4	513	428	252	168	46	49	33
RAC006	26	28	658	431	64	169	9	10	26
RAC008	28	2	535	346	170	158	20	32	30
RAC009	26	7	760	38	21	13	3	3	2
RAC011	18	6	739	380	187	197	5	25	27
RAC015	50	12	875	766	420	350	37	48	40
RAC016	26	12	519	319	152	140	82	29	27
RAC017	48	4	1209	1028	570	478	33	47	40
RAC018	56	4	530	320	147	156	14	28	29
and	66	4	539	455	249	173	37	46	32
RAC019	40	12	602	446	257	193	34	43	32
RAC020	18	4	522	377	197	170	26	38	33
RAC023	22	4	503	299	136	108	20	27	21
RAC024	36	12	564	80	175	127	26	31	23
RAC026	46	14	707	433	246	199	10	35	28

Source KTA release 15 May 2023

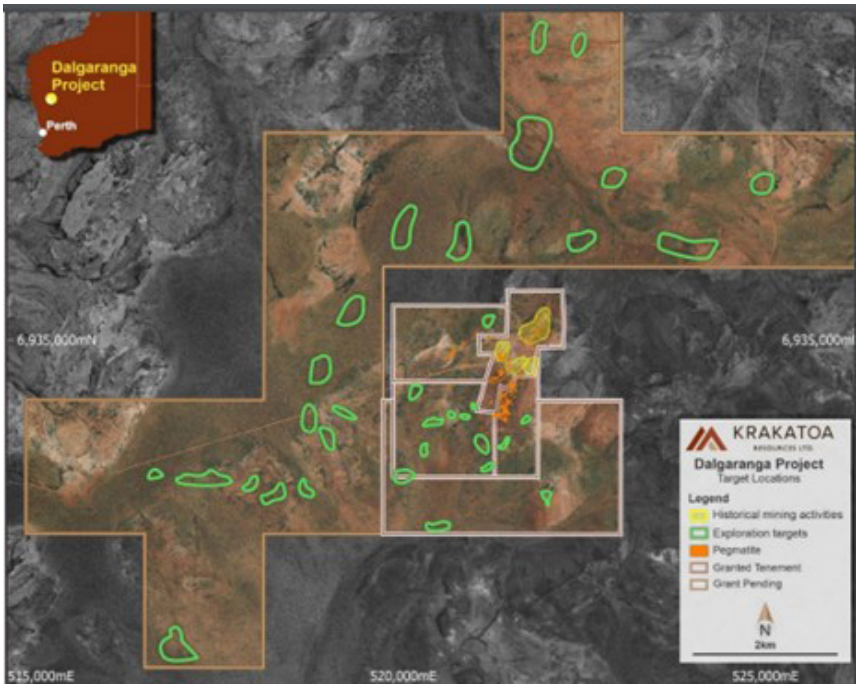
The width weighted average grade of this drilling is 690ppm TREO.

OTHER PROJECTS

King Tamba Lithium Niobium Project

Location

Figure 9 King Tamba location and areas of interest



Source: KTA release 9 March 2023

The King Tamba prospect is located 80km north-west of Mt Magnet, within the Dalgaranga Greenstone Belt in Western Australia.

Activity

Extensive Lithium Caesium Tantalum (LCT) pegmatites with Rubidium (Rb), Tantalum (Ta), Ceasium (Cs), Lithium (Li), Niobium (Nb) and Tin (Sn) enrichment has been identified, including wide zones (up to 71m) of rubidium enrichment, and an initial Resource has been published.

Mineralogy studies have commenced to identify the nature of the rubidium mineralisation to allow refinement of potential recovery processes. The company has noted that as this work is preliminary in nature there remains a risk that generation of a saleable product may not be achieved, and that any such product is dependent upon the respective recoveries of the constituent variables, and decision on the target market product.

Resource

Table 12 King Tampa Resource

	Cut-off Rb_2O %	Mt	Rb2O	Li_2O
Inferred Resource	0.05	5.00	0.14	0.05

Source: KTA release 9 March 2023

Rubidium background

Rubidium (as Rubidium carbonate) has many industrial uses, typically for enhancing stability and durability as well as reducing conductance. Rubidium is crucial to the transition toward electrification and decarbonisation of the world. It is one of the highest value critical metals with the current Rubidium Carbonate ($Rb_2CO_3 \geq 99\%$), being >USD$1,100/kg or over USD$1M per tonne.

Other projects

- Krakatoa is exploring the Mt Clere tenements for Platinum Group Metals
- The Rand tenements are being explored for gold and base metals
- The Turon Gold Project is awaiting the results of assays on chip samples collected in March 2023
- Belgravia Copper Gold Porphyry Project is currently inactive and the company is currently looking for a partner
- Mac Well Gold Project is currently inactive and the company may look for a partner

CAPITAL STRUCTURE

SHARES ON ISSUE

Table 13 Financial instruments on issue at 24 April 2023

	Million	%	Exercise Price A$/sh	Cash Raise A$M
Ordinary shares	363.38	90.9%		
Options 29 Nov 2023	21.20	5.3%	0.075	1.59
Performance Rights	15.00	3.8%		
Diluted Shares	399.58	100.0%		1.59

Source: KTA release 24 April 2023

Krakatoa has a simple share structure with ordinary shares accounting for 90.9% of fully diluted capital. The bulk of the options and all the performance rights are owned by the board and management.

MAJOR SHAREHOLDINGS

Table 14 Major shareholdings at 12 September 2022

	Million	%
Helmsdale Investmens	20.91	5.8%
Lafras Luitingh	18.78	5.2%
Peters Investments	15.00	4.1%
Citicorp Noms	8.00	2.2%
Other	300.68	82.7%
Issued Shares	363.38	100.0%

Source: KTA annual report 2022

Table 15 Directors and management interests in Krakatoa

	Shares		Options		Performance Rights	
	Million	%	Million	%	Million	%
Colin Locke	1.13	20.4%	4.00	20.9%	7.50	50.0%
Timothy Hogan	0.40	7.2%	3.00	15.7%		0.0%
David Palumbo	4.00	72.3%	2.10	11.0%		0.0%
Mark Major		0.0%	10.00	52.4%	7.50	50.0%
Total	5.53	100.0%	19.10	100.0%	15.00	100.0%

Source: KTA annual report 2022, David Palumbo ASX release 23 February 2023

BOARD AND MANAGEMENT

COLIN LOCKE – EXECUTIVE CHAIRMAN

Mr Locke has 30 years' experience in business management, mining and financial services. From 1984 to 1993, Mr Locke worked in the mining industry processing base and precious metals. During this time, he traded resource stocks and international futures contracts.

In 1993, Mr. Locke transitioned to an Australian commodity broking firm, assuming the role of Investment Advisor and subsequently becoming a Director in 1994. His entrepreneurial spirit led him to establish CK Locke & Partners, a boutique Australian Financial Services firm, in 1998. He served as the Managing Director of the company from 1999 to 2010.

In 2007, Mr. Locke acted as a Corporate Advisor during the acquisition process of the Mayoko iron ore project with DMC Mining Ltd (DMC) in the Republic of Congo, which was later taken over in 2010 for circa $50M and subsequently sold for over $300M.

From 2008 to 2015, Mr Locke focused on natural resources exploration thoughout the Indonesian archipelago and founded Western Manganese Ltd, where he held the role of Executive Director from 2010 until 2012.

In 2015, Mr Locke became Executive Chairman of Krakatoa Resources Limited, Additionally, he co-founded Albion Resources Ltd (ALB) and Rubix Resources Ltd (RB6) where he holds the position of non-executive Director.

In addition to his other roles, Mr. Locke also serves as the Executive Chairman for the Chamber of Australia Africa Mining and Investment (CHAAMI), a not-for-profit organization. In this capacity, he brings his expertise and leadership to foster collaboration and promote responsible and ethical exploration, mining and investment activities between Australia and Africa.

Throughout his career, Mr. Locke has been extensively involved in capital raisings and mineral exploration expeditions in various countries, including Bosnia, Indonesia, Gabon, Ghana, Namibia, Malawi, Madagascar, Republic of Congo, Russia, Senegal, Uganda, and Zimbabwe.

TIMOTHY HOGAN NON-EXECUTIVE DIRECTOR

Mr Hogan has approximately 25 years' experience in the stockbroking industry in Australia, initially as a founding private client advisor at Hogan and Partners. Mr Hogan has provided corporate and execution services for a wide variety of corporate and private clients.

Mr Hogan is currently a Director of Barclay Wells Limited, a boutique advisory firm that specialises in Australian resource stocks and has assisted many companies from their initial raising and flotation on the ASX through to production. Mr Hogan brings extensive experience and a wide range of contacts that benefits the company.

DAVID PALUMBO NON-EXECUTIVE DIRECTOR

Mr Palumbo is a Chartered Accountant and graduate of the Australian Institute of Company Directors with over fourteen years' experience across company secretarial, corporate advisory and financial management and reporting of ASX listed companies.

Mr Palumbo is Head of Corporate Compliance at Mining Corporate Pty Ltd, where he has been actively involved in numerous corporate transactions. Mr Palumbo has recently become Krakatoa's principal corporate advisor, leading the identification and acquisition of both the Mt Clere Rare Earth Project and Belgravia Porphyry Project.

Mr Palumbo is currently company secretary for several ASX listed companies and a non-executive director of Kaiser Reef Limited.

MARK MAJOR, BSC GEO, MBA CHIEF EXECUTIVE OFFICER

Mr Major has more than 25 years of international mineral exploration and development experience ranging from grassroots programs to mine development and has extensive experience working with corporate transactions, project acquisitions and project generation. He has previous held Managing Director, Country Manager, senior operational management roles and been a technical consultant for various private and listed companies throughout his professional career.

Mr Major has been involved with a many major and junior level companies having worked for Barrick, BHP, Glencore, Rio Tinto, WMC and various successful junior and mid-level resource companies.

He has extensive experience within Australia and internationally, worked in various countries though out South America, Asia and Africa. Mr. Major holds a degree in geology from Ballarat University and an MBA from La Trobe University. He is a Member of the AUSIMM.

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